

What is claimed is:

1. A semiconductor memory device including: a memory cell having a gate electrode formed on a semiconductor layer via a gate insulating film, a channel region disposed below
5 the gate electrode, a diffusion region disposed on both sides of the channel region and having a conductive type opposite to that of the channel region, and memory functional units formed on both sides of the gate electrode and having a function of retaining charges; and an amplifier, the memory
10 cell and the amplifier being connected to each other so that an output of the memory cell is inputted to the amplifier.
2. The semiconductor memory device according to claim 1,
15 wherein one or more transistors are connected in series to the memory cell.
3. The semiconductor memory device according to claim 1,
wherein the memory functional unit is formed so that at least a part of the memory functional unit overlaps with a part of
20 the diffusion region.
4. The semiconductor memory device according to claim 1,
wherein the memory functional unit includes a film having the function of retaining charges and whose surface is almost
25 parallel with the surface of a gate insulating film.

5. The semiconductor memory device according to claim 4,
wherein the film having the function of retaining charges is
disposed almost parallel with the side face of the gate
5 electrode.

6. The semiconductor memory device according to claim 4,
wherein the memory functional unit has an insulating film for
separating the film having the function of retaining charges
10 from the channel region or semiconductor layer, and the
insulating film is thinner than the gate insulating film and
has a thickness of 0.8 nm or more.

7. The semiconductor memory device according to claim 4,
15 wherein the memory functional unit has an insulating film
separating the film having the function of retaining charges
from the channel region or semiconductor layer and the
insulating film is thicker than the gate insulating film and
has a thickness of 20 nm or less.

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8. A display device in which the semiconductor memory
device according to claim 1 is incorporated.

9. A portable electronic apparatus in which the
25 semiconductor memory device according to claim 1 is

incorporated.

10. A semiconductor memory device including: a memory
cell having a gate electrode formed on a semiconductor layer
5 via a gate insulating film, a channel region disposed below
the gate electrode, a diffusion region disposed on both sides
of the channel region and having a conductive type opposite
to that of the channel region, and memory functional units
formed on both sides of the gate electrode and having a
10 function of retaining charges; and an amplifier, the memory
cells being paired, and outputs of the paired memory cells
being inputted to the same amplifier.

11. The semiconductor memory device according to claim
15 10, wherein the gate electrodes of the paired memory cells
integrally function as a word line, and the paired memory
cells integrally share the memory functional units at both
sides of the gate electrodes.

20 12. The semiconductor memory device according to claim
10, wherein the memory cell is rewritable in first and second
storing states of different amounts of charges accumulated in
the memory functional units and, at the time of reading, one
of the paired memory cells is in the first storing state, and
25 the other memory cell is allowed to operate in the second

storing state.

13. The semiconductor memory device according to claim
10, wherein the memory cell is rewritable in first and second
5 storing states of different amounts of charges accumulated in
each of two memory functional units formed on both sides of
a gate electrode, at the time of reading, a storing states of the
two memory functional units belonging to the same memory
cell are the same and an informations stored in memory
10 functional units belonging to one and other of the paired
memory cells are different from each other.

14. The semiconductor memory device according to claim
10, wherein a plurality of paired memory cell are connected
15 to the same amplifier, the paired memory cell are connected
to different word lines, and an output of a predetermined
paired memory cell is inputted to the amplifier by selection of
one word line.

20 15. The semiconductor memory device according to claim
10, wherein one or more transistors are connected in series
to the memory cell.

16. The semiconductor memory device according to claim
25 10, wherein the memory functional unit is formed so that at

least a part of the memory functional unit overlaps with a part of the diffusion region.

17. The semiconductor memory device according to claim
5 10, wherein the memory functional unit includes a film having the function of retaining charges and whose surface is almost parallel with the surface of a gate insulating film.

18. The semiconductor memory device according to claim
10 17, wherein the film having the function of retaining charges is disposed almost parallel with the side face of the gate electrode.

19. The semiconductor memory device according to claim
15 17, wherein the memory functional unit has an insulating film for separating the film having the function of retaining charges from the channel region or semiconductor layer, and the insulating film is thinner than the gate insulating film and has a thickness of 0.8 nm or more.

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20. The semiconductor memory device according to claim
17, wherein the memory functional unit has an insulating film separating the film having the function of retaining charges from the channel region or semiconductor layer and
25 the insulating film is thicker than the gate insulating film

and has a thickness of 20 nm or less.

21. A display device in which the semiconductor memory device according to claim 10 is incorporated.

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22. A portable electronic apparatus in which the semiconductor memory device according to claim 10 is incorporated.